

Science Collaborative Progress Report for the Period 09/01/13 through 02/28/14

Project Title: Determining the role of estuarine 'swashes' on water quality impairment along the Grand Strand of South Carolina: Impacts of land use and stormwater runoff.

Principal Investigator(s): Dr. Erik M. Smith

Project start date: September 15, 2010

Report compiled by: Dr. Erik M. Smith

Contributing team members and their role in the project:

Dr. Denise M. Sanger – Integration Co-lead

M. Richard DeVoe – Integration Co-lead

Michelle LaRocco – Local Outreach Facilitation

Dr. Susan Libes – Research Co-PI

Dr. Richard Viso – Research Co-PI

Dr. Richard Peterson – Research Co-PI

Dr. Jennifer Plunket – Research Co-PI

A. Progress overview: The overall project goal is to address how land use attributes and stormwater management practices and conveyance within swash watersheds affect nutrient and organic matter loading to those swashes, their internal transformations, and subsequent export to the coastal ocean. The ultimate intent is to enable effective management strategies, based on sound science, that improve and protect coastal water quality, particularly with respect to hypoxia, in Long Bay. To do so, the following key project objectives have been identified: 1) Work with intended users to define and develop a categorization scheme for all 14 swashes and select 4 swashes for intensive investigation during the proposed study; 2) Quantify concentrations and forms of nutrient and organic matter entering swashes via surface water and groundwater inputs; 3) Determine internal conditions and processes affecting organic matter transport and transformations in swashes; 4) Quantify the form and net tidal export of nutrients and organic matter from swashes; 5) Engage intended users to enable use of data to collaboratively develop science-based cost-effective management strategies.

During this reporting period progress on achieving Objectives 2, 3 and 4 was made. Since the last progress report, we requested and were approved for 6-month a non-cost extension of the project. The need for this additional extension is a result of the fact that one of the key members of the project's research team, Dr. Richard Peterson, was recently awarded the opportunity to participate in a research expedition to Antarctica from the end of December through April of 2014. As a result, previously planned schedule for completing the analyses of hydrologic data, for which Dr. Peterson has primary responsibility, was significantly impacted. In addition, this meant that Dr. Peterson would not be available for the final project workshop with Intended Users originally planned for late February. It was the opinion of the entire project team and select consulted intended users that Dr. Peterson's presence at the final workshop is of critical importance and that delaying the workshop was far preferable to his absence at the workshop. This extension also allowed us to catch up on the processing of archived samples for various chemical analyses, which we are farther behind in processing than anticipated, due to the sheer number of total samples collected.

B. Working with Intended Users: Maintaining a strong relationship with participating municipalities is a key success component to the NERRS Science Collaborative Swash Project, especially since the results are intended to eventually help inform planning and engineering solutions. Since the beginning of the project, local decision-makers, coastal resource managers, and researchers have been brought together to help define the problem and assist with project implementation.

During this reporting period, we have focused efforts on finalizing the swash classification with the updated boundaries in consultation with intended users. A comparison of the original classification with the updated classification will be provided to the intended user community in the next month. We will be requesting input on the final results prior to our next workshop. The research team is working to finalize the study results. We will be planning the next workshop in June to discuss the study findings and further outreach efforts. In addition, we have started to engage the new CTP coordinator, Michelle LaRocco. She is becoming familiar with the community in the Myrtle Beach area.

C. Progress on project objectives for this reporting period:

The following five key project objectives were identified for the project: 1) Work with intended users to define and develop a categorization scheme for all 14 swashes and select 4 swashes for intensive investigation during the proposed study; 2) Quantify concentrations and forms of nutrient and organic matter entering swashes via surface water and groundwater inputs; 3) Determine internal conditions and processes affecting organic matter transport and transformations in swashes; 4) Quantify the form and net tidal export of nutrients and organic matter from swashes; 5) Engage intended users to enable use of data to collaboratively develop science-based cost-effective management strategies.

The first objective was completed as proposed during earlier reporting periods (see Progress Reports from August 2011 and September 2012). The second, third and fourth objectives are all related to sampling the inputs, internal processes and outputs from the swashes. During the current reporting period, we completed all field sampling associated with these objectives. A total of 36 sampling events were conducted between the two study swashes (Table 1). Sample analysis is currently underway and all chemical analyses should be completed within the next month.

During the current reporting period, as with past reporting periods, estimates of water discharge (via ADCP measurements in Withers and water level over spillway in Dogwood) and swash water temperature, conductivity, dissolved oxygen, turbidity and chlorophyll fluorescence (via YSI sonde deployment) have been made semi-continuously. On each sampling event, grab samples were collected (via ISCO automated samplers) for concentrations of nitrogen and phosphorus (in all forms), dissolved organic carbon, particulate organic carbon, total suspended sediments, and chlorophyll a were made in surface waters of each of the upstream sampling stations as well as in the main swash body. On each sampling event, ground water samples were collected for concentrations of dissolved nitrogen and phosphorus (in all forms), and dissolved organic carbon, at each of the upstream sampling stations as well as at the main swash body discharge site. Nearly continuous measurements of Rn-222 were made in surface waters at both the Wither and Dogwood swash mouth sites, while discrete grab-samples for Rn-222 were collected from groundwater wells at mouth and each upstream site during dry and wet sampling events. In addition, weekly grab sample of surface waters for Rn-222 at each upstream site were collected. Measurements of water column primary production and community respiration were also made in the main swash body. Rainfall amounts and storm hydrographs were collected at each of the upstream events during each rain event sampling. Analytical processing for all of the above sampling is currently in progress. Periodic manual water velocity measurements at all upstream sampling stations with a hand-held Sontek Flowtracker continued during the current reporting period to overcome the discovered limitations of the in situ ISCO flow meters in accurately quantifying water velocity at the low flows experienced in these systems. Empirical relationships between level and water velocity (from

Flowtracker measurements) at each upstream station to use in determining total water discharge and nutrient/organic matter fluxes have now been made.

The fifth objective is a continuing process which will evolve throughout the project. The interactions discussed above with the Intended Users and other audiences are all important steps toward this objective.

Plans for meeting project objectives for the next six months entail completing analytical processing of archived samples (i.e., those samples without restrictive holding times), completing data analyses and data syntheses, convening a research PI meeting to merge datasets and data syntheses, convening a final project workshop between researchers and intended users to disseminate and vet research results and then discuss next steps and outcomes resulting from the research.

D. Benefit to NERRS and NOAA: None during the current reporting period.

E. Other:

During this reporting period Patrick Hutchin's MS research, which was conducted in association with this project, was published in the journal *Estuaries and Coasts*. Patrick was a NI-WB NERRS Graduate Research Fellow in 2011 whose research built off of and contributed to this project, and who also provided significant field assistance with data collection in the early years of the project. An electronic copy of this publication, "Metabolic responses of estuarine microbial communities to discharge of surface runoff and groundwater from contrasting landscapes" authored by P. Hutchins, E. Smith, E. Koepfler, R. Viso and R. Peterson, is included with this progress report. We also just recently learned that this publication will be featured in the next issue of "Coastal and Estuarine Science News" which is the Coastal Estuarine Research Federation's electronic newsletter for coastal managers and is designed to reach out to the coastal management community whose members may not be regular readers of the journal *Estuaries and Coasts*. As described by CESN, publications featured in the newsletter "are selected specifically for their strong implications for the management of coastal areas."

Table 1. Sampling events for each swash by type of event through the current reporting period.

SWASH	EVENT TYPE	EVENT DATE	EVENT #
Withers	Dry	July 7-8, 2011	1
Withers	Rain	July 24-25, 2011	2
Dogwood	Rain	August 13-14, 2011	3
Dogwood	Dry	September 13-14, 2011	4
Withers	Dry	October 4-5, 2011	5
Withers	Rain	October 10-11, 2011	6
Dogwood	Rain	November 16-17, 2011	7
Dogwood	Dry	December 11-12, 2011	8
Withers	Dry	January 2-3, 2012	9
Withers	Rain	January 11-12, 2012	10
Dogwood	Dry	January 31, 2012-February 1, 2012	11
Dogwood	Rain	February 18-19, 2012	12
Withers	Rain	March 24-25, 2012	13
Withers	Dry	April 11-12, 2012	14
Dogwood	Dry	May 1-2, 2012	15
Dogwood	Rain	May 9-10, 2012	16
Withers	Rain	May 30-31, 2012	17
Withers	Dry	June 25-26, 2012	18
Dogwood	Dry	July 16-17, 2012	19
Dogwood	Rain	August 7-8, 2012	20
Withers	Rain	August 28-29, 2012	21
Withers	Dry	September 23-24, 2012	22
Dogwood	Dry	October 17-18, 2012	23
Dogwood	Rain	November 15-16, 2012	24
Withers	Dry	January 6-7, 2013	25
Withers	Rain	February 7-8, 2013	26
Dogwood	Rain	March 13-14, 2013	27
Dogwood	Dry	April 9-10, 2013	28
Withers	Rain	April 29-30, 2013	29
Withers	Dry	May 15-16, 2013	30
Dogwood	Rain	June 3-4, 2013	31
Dogwood	Dry	July 9-10, 2013	32
Withers	Rain	August 15-16, 2013	33
Withers	Dry	August 28-29, 2013	34
Dogwood	Dry	September 17-18, 2013	35
Dogwood	Rain	October 9-10, 2013	36